



## Sample LIMS/Letter Article

### Refining Lab Information for Petroleum Production Control

As with most industrial applications, lab information in a petroleum refinery is essential to confirming the content and quality of the various end products. If that information isn't readily accessible and transferable, the process can be as slow as walking through sludge. For Marathon Oil's refinery (Texas City, TX), the need to upgrade their lab data management process to accommodate the data access needs of production control drove the implementation of their first LIMS.

Marathon Oil's various sites throughout the U.S. possess a variety of lab data management capabilities, depending on what has been in place historically, the sample processing volume of the particular site, and the particular site's data reporting needs. One large-volume location has had LIMS in place since the 1980's. But others, like the Texas City site, did not have a LIMS and had been processing data manually while relying upon spreadsheet software for reporting needs.

#### Data Access Demands

But the demands for greater data access, reporting functionality and auditability that have been a driving force behind other LIMS implementations have also affected Marathon's Texas City site. "We couldn't even archive data electronically -- that was the weak link," states Dennis Sutton, Lab Supervisor. "We were providing information to production control on hard copy spreadsheet printouts. It really wasn't very efficient and they wanted more."

Marathon's Texas City refinery pumps some 70,000 barrels per day of sweet crude oil, from which they extract numerous products, including gasoline, kerosene, diesel, LPG's (liquefied petroleum gases), light gases, gas oil, and specialty petrochemical feedstocks such as benzene, toluene and xylene. They perform numerous analyses of these materials from analyzing fractions to analysis of finished product specifications against industry-standard ASTM tests to show conformance to specifications.

The lab's gas chromatographs and distillation equipment operate around the clock analyzing approximately 150 to 200 samples per day, generating around 1000 data points into the LIMS. Information was manually logged into lab notebooks and subsequently input into a Lotus 1-2-3® spreadsheet for reporting. Hard copy printouts of these reports were then given to production control for comparison with data in their Plant Information (PI) process control system from Oil Systems, Inc. (San Leandro, CA).

The turning point came with the addition of reformulated gasoline (RFG) to the laboratory's workload. RFG requires additional record keeping as mandated by the Environmental Protection Agency (EPA), pushing two areas of concern to the fore. First, the auditability of the data would be much more difficult to accomplish because the spreadsheet format did not offer a way to determine when the data had been updated or by whom. Second, the long term archival issues of data storage and retrieval had the potential to become extremely time-consuming in a manual data management environment. "If you want to go back through several years of data, this could be a real problem," Sutton points out.

The search for a LIMS began in earnest. A review of the installed LIMS at other Marathon sites was the first step, however, the resulting information didn't unearth an optimal solution for the Texas City refinery. "The LIMS that other Marathon Oil sites had installed were a bit too pricey for us and demanded more of a system manager's time than we wanted to spend," Sutton explains. "We just don't have that big of an operation at this site, and we don't have that many people. So we decided to look at alternative solutions."

#### In-House Team Analyzes Alternatives

An informal in-house team of lab staff was organized to research the various vendors and products on the market. Refinery staff and members of the computer services group were called upon for their input at various stages of the project. During the LIMS evaluation that ensued, Marathon compared price and capability and put together a short list of key requirements specific to their operation.

"One of our main goals was to get our lab data into the plant information system," declares Kyle Kern, Shift Tester and part-time Lab Systems Administrator. "The Lotus spreadsheet just couldn't do it. Accountability and auditability were also major factors that we considered when comparing LIMS products."

Because of the EPA requirements regarding RFG, record keeping flexibility was a key criteria. In addition, Marathon analyzes waste water samples, which fall under the jurisdiction of certain state agencies, adding another layer of accountability. Thus, any LIMS would need to meet the reporting and record-keeping requirements of the various regulatory agencies.

The issue of LIMS management and maintenance was also a subject of concern. "We're a small lab of 15 people, including 13 analysts and two chemists," explains Sutton. "We're not able to devote anyone full time to the management of information. Kyle does this in addition to his 'regular' job."

During the review, which included several product demonstrations, Windows-based products came to the fore because they are easy to use, similar to popular off-the-shelf software such as Lotus 1-2-3, and relatively easy to maintain. After comparing price and features against other Windows-based LIMS, Analytical Automation Specialist's LABWORKS product was subsequently selected and installed in early 1995. LABWORKS "fit the needs of a facility our size and had the features we needed without a lot of superfluous add-ons," states Sutton. "References from other petroleum refineries were also favorable."

### **Simultaneous System Use During Installation**

Rather than install the new system and immediately discontinue the former spreadsheet process, both systems worked simultaneously while formal training and testing were conducted. "We wanted to ensure that the analysts demonstrated proficiency before the final cutover," Kern recalls.

Because the lab was already used to working with spreadsheets, learning to use another computer interface was not difficult, and training progressed without incident. "We spent about six weeks in this installation/implementation process," adds Sutton. "It could have been done in two but we wanted to ensure a flawless final cutover. In the end, the analysts complained about having to use two systems and asked us to hurry up!"

Since installation, Marathon has used their new LIMS to input specifications and log in scheduled time and date stamped samples from operating units. Both daily and end-of-the-month summary reports are generated using the report writer capability in addition to exception reports and historical summaries which were not previously possible. And, data can now be transferred to the PI system electronically for further analysis and inspection rather than relying solely on hard copy spreadsheets. This allows the plant engineers to easily combine lab data with process information -- such as temperatures, flow rates and pressures -- into a single report or display screen.

The biggest benefit to Marathon's new LIMS is the tremendous time saver it has become for data management. "Now, retrieval of data and information is a snap," Kern observes. "Rather than having to look through information by hand and put what we want into the spreadsheet, we can just use a quick cross-reference search to pull up the required data for analysis and reporting." The monthly summary reports are particularly helpful since Marathon can now pull an entire month's data and look up average properties and other criteria with ease.

### **Launching QA/QC Capabilities Comes Next**

Sutton reports that the majority of the staff are adjusting well to the added functionality that electronic data brings. The next step is to leverage other capabilities of their new LIMS.

"In the future, we plan to explore the manner in which we provide data to other areas of the company, particularly the operations, products control and environmental departments," states Sutton. "It's possible that we can help those areas with our reporting capabilities, particularly in the modification and presentation of data." "We also want to use the LIMS as a management tool and look at such things as the cost per sample, the test time per sample and the workload balance, to compare our operation with, for instance, an independent contract lab, to determine how cost effective our operation is," he continues.

Marathon's short-range goals are equally down to earth and specific. Currently they are implementing various quality control functions to schedule SQC routines. Once such capabilities are in place, they plan to use various statistical tools to monitor laboratory performance and automatically print certificates of analysis (COAs).

Now that the data transfer between the lab and Operations' production control systems has been automated and streamlined, Marathon Oil is able to readily address the increased regulatory requirements and can get on with the task of using the new information system to more closely track and assess end products. Time that was previously spent collecting data can now be spent analyzing it.

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